

Title: Slides, Flips, and Turns -- Tessellation Exploration

Brief Overview:

Students will investigate tessellations as they use pattern blocks to design a “placemat”. In doing so, they will examine what properties allow a figure to tessellate. Students also will develop an understanding of movement within tessellations and acquire specific math vocabulary. Their final product will be a placemat that can be laminated and displayed and a paragraph that describes the mathematics that goes into its development. This is an enjoyable activity for kids that demonstrates appropriate math content. It takes approximately two to three classroom periods.

Links to NCTM Standards:

- **Mathematics as Problem Solving**

Students will demonstrate their ability to solve problems in mathematics as they address an open-ended problem which contains a variety of solutions and is visually stimulating. Students can either work cooperatively or individually. This also prepares them for further explorations in tessellations using software products such as *TessellMania* (MECC).

- **Mathematics as Communication**

Students will demonstrate their ability to communicate mathematically as they acquire specific math vocabulary and use it to explain how a shape is able to tessellate. They also will write an informative paragraph that will be displayed with their placemat that describes tessellation and the mathematics that are found in the design of the placemat.

- **Mathematics as Reasoning**

Students will demonstrate their ability to reason mathematically as they develop tiles and expand them into tessellations. They should be able to explain how a figure does or does not tessellate.

- **Mathematical Connections**

Students will demonstrate their ability to connect mathematics topics within the discipline and with other disciplines as they examine geometry using spatial relationships and visual patterns and are able to use them in an artistic setting. They also will complete a writing prompt that will allow them to demonstrate understanding of the concept.

- **Geometry and Spatial Sense**

“Students’ understanding of the angle properties of polygons can be enhanced through explorations of tessellations with regular polygons.” (NCTM 1989a, p. 115) Students will demonstrate symmetry, reflection, and 2D rotation (slides, flips, and turns). Students also will describe the characteristics of two dimensional shapes and the effects of combining them.

- **Patterns and Relationships**

Students will demonstrate their ability to recognize and define patterns and relationships as they create, explain, and extend patterns containing polygons.

Grade/Level:

This activity is suitable for grades 3-4 with appropriate modifications.

Duration/Length:

2 to 3 classroom sessions (variable)

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

- Names and attributes of the polygons contained in pattern blocks
- Understanding of symmetry
- Understanding of tiling or creating simple designs using pattern blocks

Objectives:

Students will:

- describe the characteristics of two dimensional shapes and the effect of combining them.
- identify and demonstrate symmetry and 2D rotation (slides, flips, and turns).
- identify and create a tessellated pattern using combinations of polygons.

Materials/Resources/Printed Materials:

- Transparency film, overhead pens, and overhead pattern blocks (optional)
- Pattern Blocks and student copies of Resource Sheet 1
- Transparency and student copies of Pattern Block Triangle Paper, Resource Sheet 2
- Construction paper, tape, scissors, glue, crayons and markers, etc. (The artistic aspect of this activity can be extended through the use of exotic or colored papers such as those found in discarded wallpaper sample books or wrapping papers.)
- Examples of tessellations. (The work of M. C. Escher immediately comes to mind but examples of tessellations can be found everywhere, in places such as tiled walls, floors, and brick pavements.)
- Sentence strips (optional)
- Writing paper

Development/Procedures:

- Provide motivation by distributing trays of pattern blocks to groups of students. Allow them to “play” with the blocks. Encourage them to use one or two blocks to create a design. State that the only rule is that they have no spaces within their design and that their designs should be several blocks high and wide. After allowing a sufficient time for completion, conduct a gallery walk so that students can observe each others designs.
- Begin the lesson by stating that what they have created is called a tessellation. Either by using a sentence strip or using the chalkboard, display the word and it’s definition. State that a tessellation is a design using a single shape that contains no gaps and can be repeated in all directions.
- State that examples of tessellations are found everywhere. Show examples of tessellations. (Be sure to note the individual shape that is tessellated.) Using think-pair-share, ask students to contribute examples of tessellations and write examples on chalkboard.

- State that a tessellation contains a single shape that is moved in different directions in a way so that there are no gaps and the pattern is repeated. Recall the definition of symmetry and state that a tessellation contains examples of symmetry. Using a drawing or an overhead pattern block, show an example of symmetry.
- State that in order to create our pattern block tessellations we have to move our polygons. State that those moves have names. Either using sentence strips or chalk, display the words slide, flip, and turn.
- Using a overhead pattern block, demonstrate a slide. Check for understanding by having student demonstrate a slide at their desk using a pattern block.
- Using a overhead pattern block, demonstrate a flip. Check for understanding by having student demonstrate a flip at their desk using a pattern block.
- Using a overhead pattern block, demonstrate a turn. Check for understanding by having student demonstrate a turn at their desk using a pattern block.
- Provide for formative assessment by distributing either Resource Sheet 3 or 4 (depending on your students), have them complete independently.

Note: This is a logical point to end this segment of the activity.

- Begin the motivation/drill by distributing pattern blocks and allowing students to create designs using the blocks. Allow for recall of the previous lesson by asking students to restate and give examples of slide, flip, and turn moves. Have students show how in their designs they used the slide, flip, or turn moves.
- Provide for guided practice and independent activity by distributing scissors and copies of Resource Sheet 1 and 2. Instruct students to cut out the pattern block shapes on Resource Sheet 1. While students are cutting out the pattern blocks, distribute pieces of tape to each student.
- Ask students to select two polygons and tape them together. Stress that two pattern blocks that were taped together are now a new polygon. State that they will be using this new polygon to create a tessellation.

Note: Differentiation for students of can be accomplished simply by varying the number of pattern blocks used to create a single shape. A tessellation can be completed using one pattern block, or two or more pattern blocks taped together. It is also important to note that the polygons must be taped so that the sides meet without gaps. Remember, not all shapes tessellate. Students will be creating shapes that will not create true tessellations. This is an opportunity for discovery on the part of the students as they use trial and error to create a shape that can tessellate.

- The teacher can model completion of the guided practice by taping two overhead pattern blocks together, and using a transparency of Resource Sheet 2, Pattern Block Triangle Paper model completion of a tessellation. Use overhead pens to color the design.
- Have students use their cut-out pattern blocks, pattern block triangle paper, and crayons and create a tessellated design. Stress that their design must be consistent, free of gaps, and cover all the triangles on the paper.

Note: This essentially completes the guided practice/independent activity portion of this lesson. Students can simply cut out their tessellated design on the pattern block triangle paper and glue it on construction for display. The artistic aspect of this activity can be enhanced through the creation of a collage using different types of paper including construction paper, wallpaper, and wrapping paper. The student uses the new polygon as a template to trace and cut out copies of the polygon and glue them on construction paper in the form of a tessellation.

- Distribute Student Resource 6. Introduce the Math Journal prompt. Stress that math vocabulary should be used, all diagrams should be clearly labeled, it should be well written, and that a personal reflection should be included. Students should complete their patterns on a placemat paper to be laminated and displayed.

Performance Assessment:

The summative assessment takes the form of the successful completion of the placemat which shows an example of a true tessellation. Assessment also takes the form of successful completion of the journal prompt which describes the mathematics of tessellation, how it is shown in the design of the placemat, a definition and examples of slide, flip, and turn and a personal response to the activity. The completion of Resource Sheets 4 and 5 is a formative assessment of the understanding of the basic tessellation moves. A journal prompt and a scoring tool (checklist) is supplied.

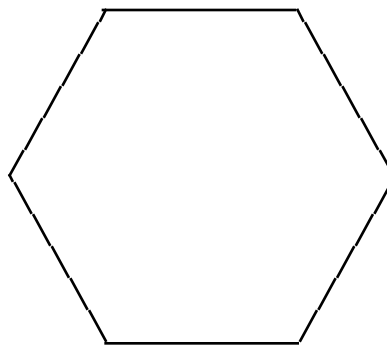
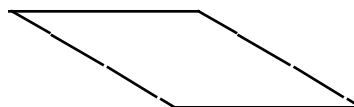
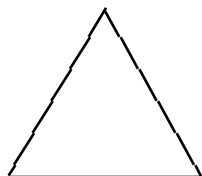
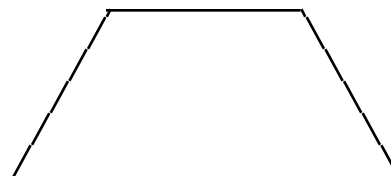
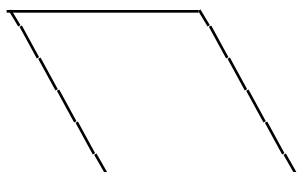
Extension/Follow Up:

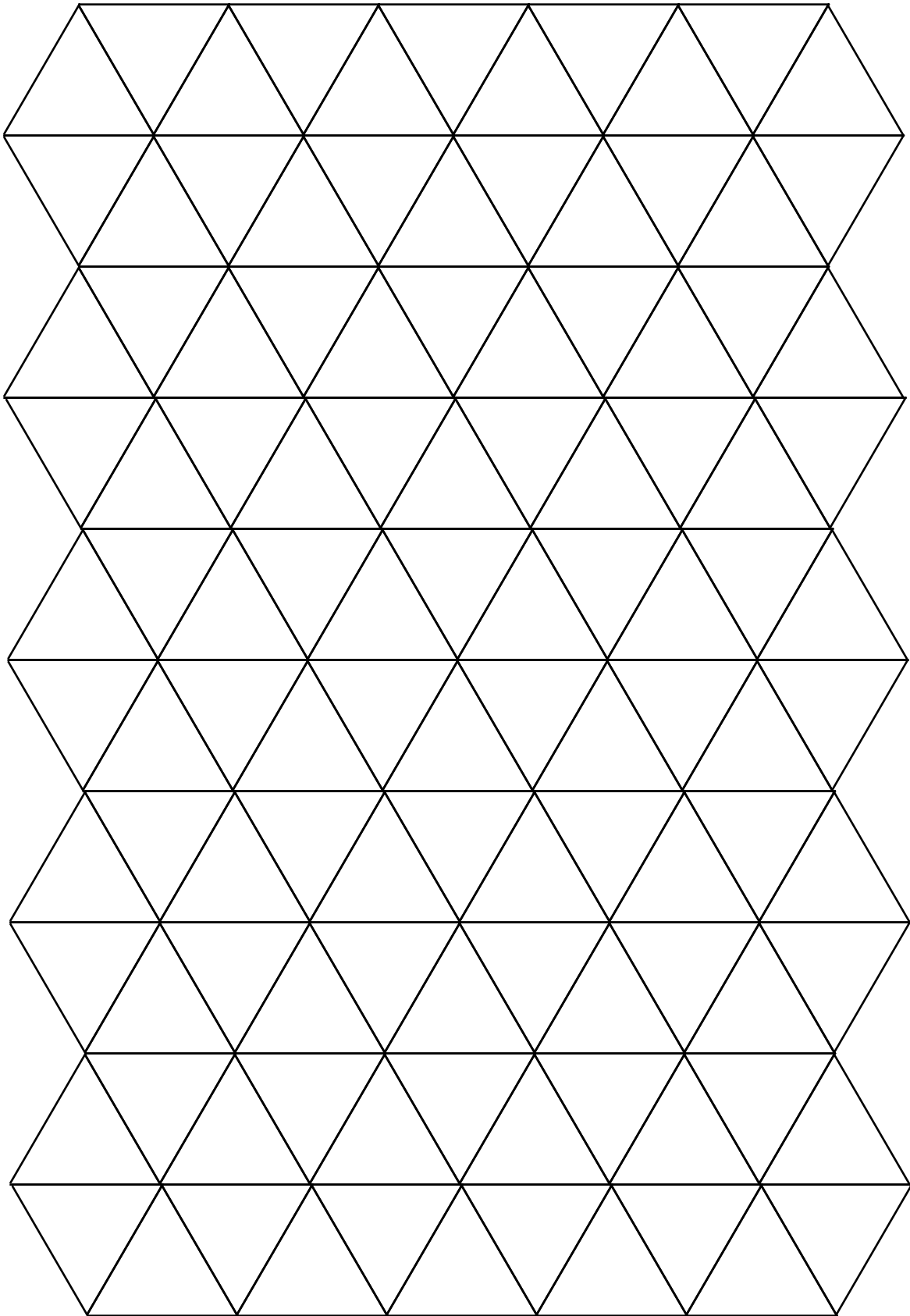
There are a number of sites on the Internet on tessellations. The teacher only has to use a search feature on a site such as Yahoo and the key word tessellations in order to find current sites. The software program *Tessellmania* by MECC provides an excellent opportunity for the design of tessellations from the simple to the complex.

Author:

Donald L. Cooper
Halstead Academy
Baltimore County, MD

Template for Pattern Blocks

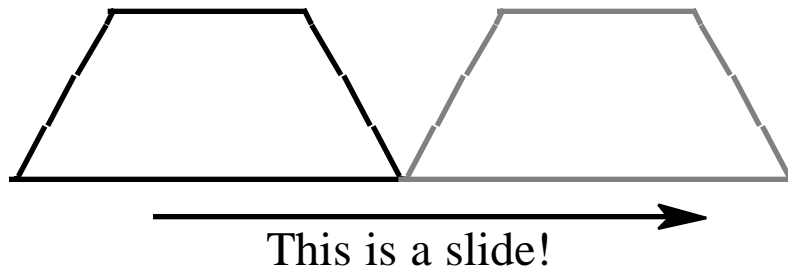




Slides, Flips and Turns

When we create designs using pattern blocks, it is as if we are creating a puzzle. We move them in different ways to create our pattern. These moves have names such as *slides*, *flips*, and *turns*.

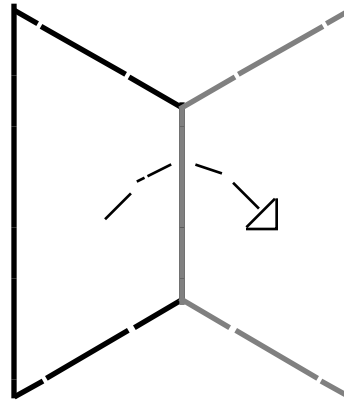
These are examples:



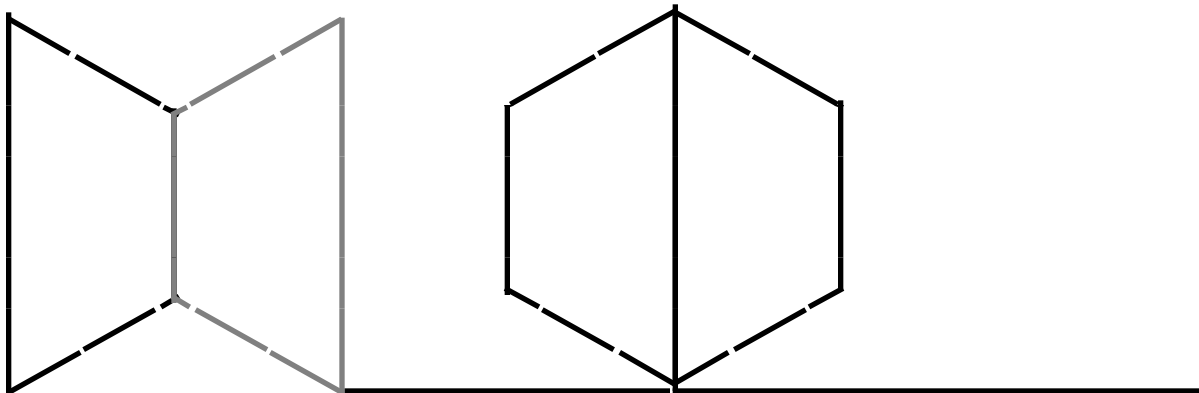
Complete the pattern:

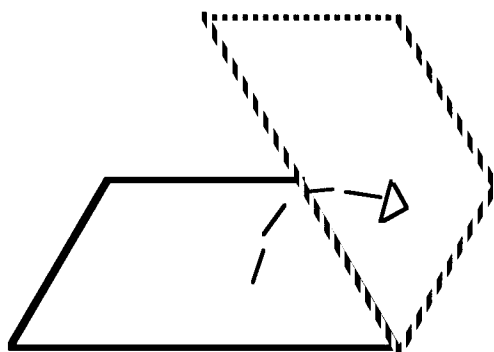


This is a flip!



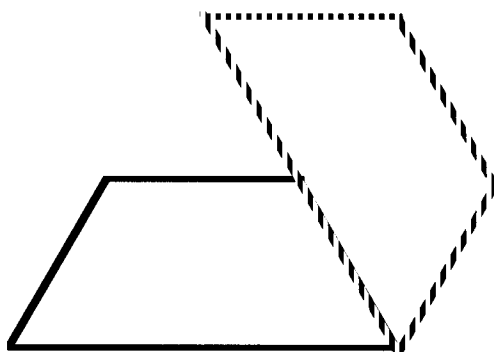
Complete the pattern:





This is a turn!

Complete the pattern:



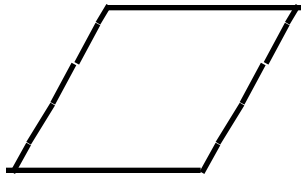
Extend your pattern by adding color. What could this be in real life? Would it be fun to use? Why or why not?

Slides, Flips, and Turns

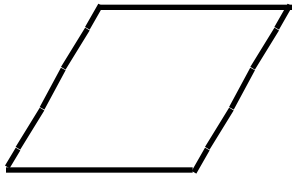
Practice what you learned!

Using the shape below, create a tessellation where it:

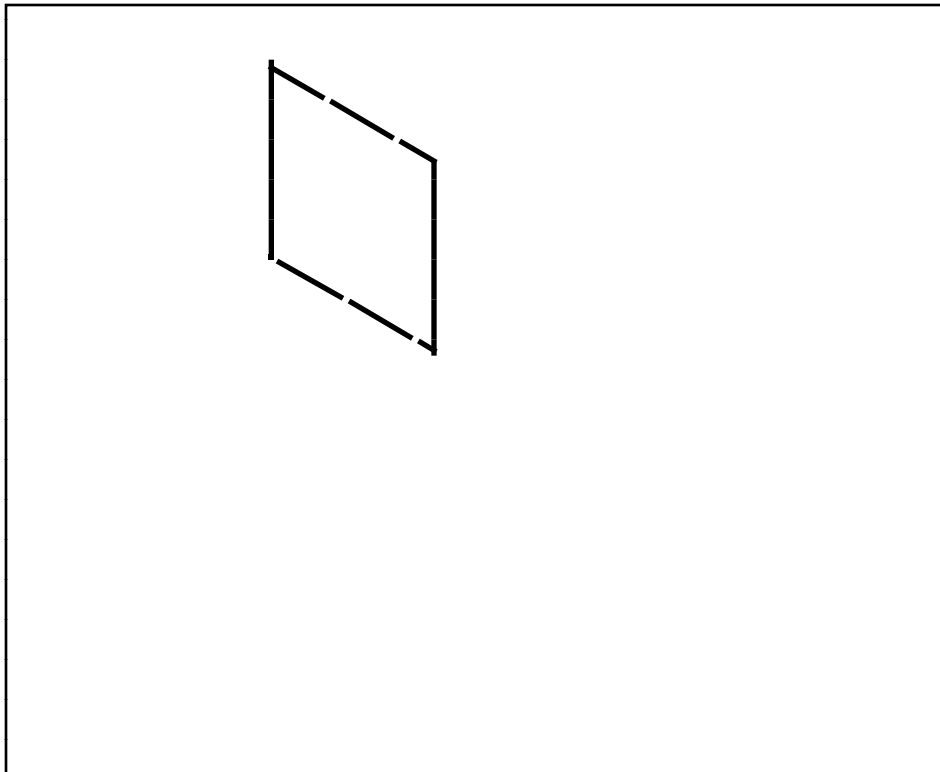
Slides:



Flips:



Turns:



Extra Credit!!

On the back of this sheet, use a pattern block of your choice and create a design that shows what you've learned.

Math Journal

Now that you have completed your placemat, it is now time for you to think about what you've learned and how it's shown in your design.

Your placemat will be displayed for other students to view. Few will understand that this is a math activity. Write a paragraph that describes how your design is an example of tessellation.

In your paragraph you should explain what a tessellation is and how it is shown in your design. You should also include a drawing of your basic shape that shows the three tessellation moves. Make sure your diagrams are labeled. Your paragraph should be neat, use proper grammar, spelling, and punctuation, and contains math language. End your paragraph with a personal reflection on your project. Do your best. Your completed paragraph will be displayed with your placemat.

Tessellation Placemat Checklist

The successful completion of the placemat demonstrates the ability to select or create a shape that has the ability to tessellate. The shape is then repeated within a grid so that there are no gaps and the pattern is consistent throughout the plane. There should be evidence that the student has an understanding of the three tessellation moves and the mathematics involved in the activity.

Placemat Checklist

- _____ The student has selected a polygon that is able to tessellate.
- _____ The polygon is manipulated within the grid so that the pattern is consistent throughout and that there are no gaps.
- _____ The student demonstrates an understanding of the three tessellation moves.
- _____ The student has completed a written journal response that describes the activity in mathematical terms, demonstrates an understanding of the three moves, contains accurate labeled drawings of the tessellated polygon, and has a personal reflection.
- _____ The completed project is visually cohesive and appealing and demonstrates a clear understanding of the concept.